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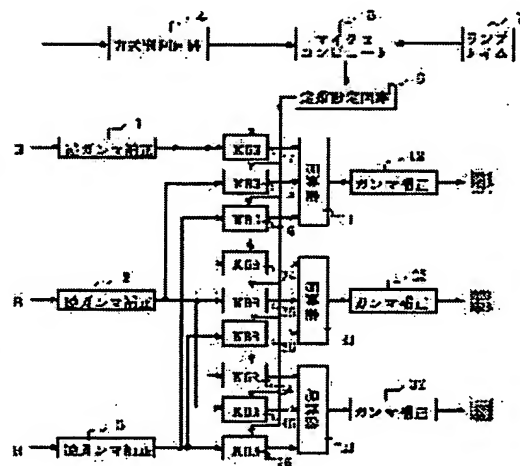
(54) LIQUID CRYSTAL PROJECTOR

(57)Abstract:

PURPOSE: To enable reproducing of color in specified ranges respectively with plural systems having different color reproducing ranges to be conducted by storing color compensation constant in accordance with standards of various signal systems and compensating a hue corresponding to standards of each signal systems.

CONSTITUTION: For instance, a primary signal of G is inputted to a system discriminating circuit 4, it is discriminated that which system is used for the signal by this system discriminating circuit 4, and the result is inputted to a microcomputer 5. The microcomputer 5 gives a constant to gain adjusting circuits 14-16, 24-26, 34-36 from a constant decision circuit 6 corresponding to each system in accordance with the result. Also, an

output from a lamp time circuit 7 which measures used lamp time is given to the microcomputer 5, and a compensation constant caused by waste of the lamp is given to gain adjusting circuit 14-16, 24-26, 34-36. Matrix circuits of G, B, R are formed with gain adjusting circuit 14-16, 24-26, 34-36 and adders 11, 21, 31, and three colors are mixed with desired ratio.



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CLAIMS

[Claim(s)]

[Claim 1] An optical separation means to divide into three components of red, green, and blue at least the light from red, green, the light source that emits the light of three blue components, and the light source concerned, Green [which were separated by the optical separation means concerned / the red, green], In a liquid crystal projector equipped with the projector lens which carries out expansion projection of a liquid crystal display means to be inserted into the optical path of the light of three blue components, and to modulate the light of said three components according to image information, a photosynthesis means to compound optically the light of three components which penetrated the liquid crystal display means concerned, and said image information The liquid crystal projector which comes to have the means which stores the hue amendment constant according to the specification of various signal systems at least, and carries out hue amendment corresponding to the specification of each signal system.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the liquid crystal projector which performs color display using the light source, a liquid crystal panel, and a projector lens.

[0002]

[Description of the Prior Art] Conventionally, the projection mold liquid crystal display which can perform image display of a big screen as a liquid crystal display is known. The light emitted from the light source is irradiated on a liquid crystal panel, and by making the optical image corresponding to a video signal form in this liquid crystal panel, it consists of this projection mold liquid crystal display so that it may be made to penetrate by performing an exposure luminous-intensity modulation, incidence of that transmitted light may be carried out to a projection lens and expansion projection of said optical image may be carried out at a screen.

[0003] In such a projection mold liquid crystal display, as it is shown in the block diagram of drawing 7 when displaying a full color image for example, the light emitted from the light source 101 For example, a reflector is turned to an one direction by the reflector 102 formed in the paraboloid. After omitting a heat ray and ultraviolet rays with a filter 103, G primary lights (green light) are separated by the G reflective dichroic mirror 104, and R primary lights (red light) and B primary lights (blue glow) are separated by the R reflective dichroic mirror 105.

[0004] After being reflected by the reflective mirror 106, incidence is carried out to the condensing lens 107 for G systems, it is condensed, and incidence of the G primary lights separated with the G reflective dichroic mirror 104 is further carried out to the liquid crystal panel 108 for G systems. And after intensity modulation is carried out with the optical image corresponding to the video signal of G system formed in this liquid crystal panel 108, the R reflective dichroic mirror 109 and the B reflective dichroic mirror 110 are penetrated from a liquid crystal panel 108, incidence is carried out to the projection lens 111, and expansion projection is carried out at a screen 112.

[0005] Incidence is carried out to the condensing lens 113 for R systems, it is condensed, and incidence of the R primary lights separated with the R reflective dichroic mirror 105 is further carried out to the liquid crystal panel 114 for R systems. And after intensity modulation is carried out with the optical image corresponding to the video signal of R system formed in this liquid crystal panel 114, incidence is carried out to the R reflective dichroic mirror 109 from a liquid crystal panel 114, after being reflected here and compounded with the optical image of G system, the B reflective dichroic mirror 110 is penetrated, incidence is carried out to the projection lens 111, and expansion projection is carried out at a screen 112.

[0006] With the R reflective dichroic mirror 105, ***** B primary lights After penetrating the condensing lens 115 for B systems, incidence is carried out to the liquid crystal panel 116 for B systems. After intensity modulation was carried out with the optical image corresponding to the video signal of B system formed in this liquid crystal panel 116, Incidence is carried out to the B reflective dichroic mirror 110 through the reflective mirror 117 from a liquid crystal panel 116, after being reflected here and compounded with the synthetic optical image of G system and R system, incidence is carried out to the projection lens 111, and expansion projection is carried

[0016] When the primary color B of the primary color G of the primary color R of a chromaticity (xR, yR) and brightness YR, a chromaticity (xG, yG), and brightness YG, a chromaticity (xB, yB), and brightness YB is obtained similarly, (x, y) of the color mixture of the three colors, and brightness Y can be expressed like the following formula 2.

[0017]

[Equation 2]

$$x = \frac{x_R \frac{Y_R}{Y_R} + x_G \frac{Y_G}{Y_G} + x_B \frac{Y_B}{Y_B}}{\frac{Y_R}{Y_R} + \frac{Y_G}{Y_G} + \frac{Y_B}{Y_B}}$$

$$y = \frac{y_R \frac{Y_R}{Y_R} + y_G \frac{Y_G}{Y_G} + y_B \frac{Y_B}{Y_B}}{\frac{Y_R}{Y_R} + \frac{Y_G}{Y_G} + \frac{Y_B}{Y_B}}$$

$$Y = Y_R + Y_G + Y_B$$

[0018] (x, y), and Y become the chromaticity of the white at the time of carrying out color mixture of R, G, and the B, and brightness. When a definition is given like a formula 3 as a stimulus value here, x and y can be expressed like a formula 4 using k.

[0019]

[Equation 3]

$$k_R (= \frac{Y_R}{Y_R}), k_G (= \frac{Y_G}{Y_G}), k_B (= \frac{Y_B}{Y_B})$$

[0020]

[Formula 4]

$$x = \frac{k_R x_R + k_G x_G + k_B x_B}{k_R + k_G + k_B}, y = \frac{k_R y_R + k_G y_G + k_B y_B}{k_R + k_G + k_B}$$

(4) 式

[0021] a basis with the formula 2 of the above [the white which will be obtained if the above-mentioned chromaticity of R, G, and B and brightness are assumed to be what was obtained by the liquid crystal projector which does not perform circuit-amendment at all here] too — becoming .

[0022] Since it is determined by the parameter of optical element components about (xR, yR), (xG, yG), and (xB, yB), modification by circuit-amendment is impossible, but since it is possible to control the brightness YR, YG, and YB of each monochrome in circuit, it is clear that the balance of this is changed and a white color temperature can be controlled.

[0023] Next, the case where G monochrome is displayed, for example is considered. Although the chromaticities and brightness which are obtained by usual are (xG, yG), and YG, when a part of signal of G is intentionally mixed to the video signal of R and B and the permeability of light is given to the liquid crystal panel of R and B, the chromaticity and brightness which are obtained are too expressed with a formula 2.

$$x_{1T} = \frac{k_{1R} x_R + k_{1G} x_G + k_{1B} x_B}{k_{1R} + k_{1G} + k_{1B}}, \quad y_{1T} = \frac{k_{2R} y_R + k_{2G} y_G + k_{2B} y_B}{k_{2R} + k_{2G} + k_{2B}}$$

[0036] It is a constant by the side of the circuit which realizes the constant k which is alike and is calculated more.

[0037] This invention amends by constituting companion a radical by realizing a circuit for each formula mentioned above. Drawing 1 shows the example of a fundamental circuit which realizes the above. Actuation of this circuit is explained below.

[0038] Since the gamma correction is performed according to the property of CRT, a reverse gamma correction is performed in the reverse gamma correction circuits 1, 2, and 3, respectively, and the primary signal of G, B, and R which have been first sent from the circuit of the preceding paragraph is re-amended by the linear condition.

[0039] And the gain adjustment of the primary signal of G, B, and R which were re-amended by the linear condition is carried out in the gain equalization circuits 14-16, the gain equalization circuits 24-26, and the gain equalization circuits 34-36, respectively. And the primary signal of G, B, and R by which the gain adjustment was carried out is given to adders 11, 21, and 22, respectively, and three colors are mixed at a desired rate. That is, in a linear field, with the gain equalization circuits 14-16, 24-26, and 34-36 and adders 11, 21, and 22, the matrix circuit of G, B, and R is formed and it mixes at the rate of a request of three colors. The example of the video signal acquired at this time is given to drawing 4 as an example. Then, in order to return a video signal to the original condition, a gamma correction is applied in the gamma correction circuits 13, 23, and 33, respectively, and an amendment signal is sent to the circuit of the next step. And finally, it is projected on G, B, and R which were mixed at a desired rate on a screen, and they can obtain a desired chromaticity.

[0040] Drawing 2 prepares two or more sets of constants K of the matrix shown in a formula 7, and is the block diagram showing the important section of this invention constituted for the business which is doubled with that color reproduction range according to an input signal, and which carries out appearance control. In this example, two or more constants K of the matrix shown in the formula 7 mentioned above in the parameter input circuit 6 construct, and are stored. And for example, the primary signal of G is inputted into the method distinction circuit 4, it distinguishes which method it is and that result is given to a microcomputer 5 in this method distinction circuit 4. According to the result, a microcomputer 5 corresponds to each method from the constant decision circuit 6, and a constant gives it to the gain equalization circuits 14-16, 24-26, and 34-36. Moreover, the output from the lamp time circuit 7 which measures the time of a lamp is given to a microcomputer 5, and the amendment constant by consumption of this lamp is also given to the gain equalization circuits 14-16, 24-26, and 34-36. With the gain equalization circuits 14-16, 24-26, and 34-36 and adders 11, 21, and 22, the matrix circuit of G, B, and R is formed and it mixes at the rate of a request of three colors. Then, in order to return a video signal to the original condition, a gamma correction is applied in the gamma correction circuits 13, 23, and 33, respectively, and an amendment signal is sent to the circuit of the next step. And finally, it is projected on G, B, and R which were mixed at a desired rate on a screen, and they can obtain a desired chromaticity.

[0041] the difference between the color reproduction range in case this invention is not included in drawing 6, and the color reproduction range at the time of adopting this invention was shown — it is shown. This drawing 6 is the result of doubling the color reproduction range with the chromaticity specification of Hi-Vision using this invention. As the original design, the color reproduction range [a little] larger than the color reproduction range of Hi-Vision is secured by optical system, and it turns out that doubling with specification by the amendment circuit is possible.

[0042] The block diagram of the drive circuit of the liquid crystal projector which contains this invention in drawing 5 is shown. It explains per actuation of the drive circuit shown in drawing 5. First, a luminance signal (Y) and a color-difference signal (PB, PR) are changed into an RGB

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TECHNICAL FIELD

[Industrial Application] This invention relates to the liquid crystal projector which performs color display using the light source, a liquid crystal panel, and a projector lens.

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PRIOR ART

[Description of the Prior Art] Conventionally, the projection mold liquid crystal display which can perform image display of a big screen as a liquid crystal display is known. The light emitted from the light source is irradiated on a liquid crystal panel, and by making the optical image corresponding to a video signal form in this liquid crystal panel, it consists of this projection mold liquid crystal display so that it may be made to penetrate by performing an exposure luminous-intensity modulation, incidence of that transmitted light may be carried out to a projection lens and expansion projection of said optical image may be carried out at a screen.

[0003] In such a projection mold liquid crystal display, as it is shown in the block diagram of drawing 7 when displaying a full color image for example, the light emitted from the light source 101 For example, a reflector is turned to an one direction by the reflector 102 formed in the paraboloid. After omitting a heat ray and ultraviolet rays with a filter 103, G primary lights (green light) are separated by the G reflective dichroic mirror 104, and R primary lights (red light) and B primary lights (blue glow) are separated by the R reflective dichroic mirror 105.

[0004] After being reflected by the reflective mirror 106, incidence is carried out to the condensing lens 107 for G systems, it is condensed, and incidence of the G primary lights separated with the G reflective dichroic mirror 104 is further carried out to the liquid crystal panel 108 for G systems. And after intensity modulation is carried out with the optical image corresponding to the video signal of G system formed in this liquid crystal panel 108, the R reflective dichroic mirror 109 and the B reflective dichroic mirror 110 are penetrated from a liquid crystal panel 108, incidence is carried out to the projection lens 111, and expansion projection is carried out at a screen 112.

[0005] Incidence is carried out to the condensing lens 113 for R systems, it is condensed, and incidence of the R primary lights separated with the R reflective dichroic mirror 105 is further carried out to the liquid crystal panel 114 for R systems. And after intensity modulation is carried out with the optical image corresponding to the video signal of R system formed in this liquid crystal panel 114, incidence is carried out to the R reflective dichroic mirror 109 from a liquid crystal panel 114, after being reflected here and compounded with the optical image of G system, the B reflective dichroic mirror 110 is penetrated, incidence is carried out to the projection lens 111, and expansion projection is carried out at a screen 112.

[0006] With the R reflective dichroic mirror 105, ***** B primary lights After penetrating the condensing lens 115 for B systems, incidence is carried out to the liquid crystal panel 116 for B systems. After intensity modulation was carried out with the optical image corresponding to the video signal of B system formed in this liquid crystal panel 116, Incidence is carried out to the B reflective dichroic mirror 110 through the reflective mirror 117 from a liquid crystal panel 116, after being reflected here and compounded with the synthetic optical image of G system and R system, incidence is carried out to the projection lens 111, and expansion projection is carried out at a screen 112.

[0007] By the way, in a liquid crystal projector with the optical system shown in drawing 7, the color reproduction range is expressed on xy chromaticity diagram of CIE, as shown in drawing 8.

[0008] The chromaticity in three primary colors on this chromaticity diagram and brightness are

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to this invention, it becomes realizable [the projector in which color reproduction can do two or more methods with different color reproduction range in each appointed range]. Moreover, if the constant for which it was suitable beforehand is set up also to aging of whenever [by aging of a lamp / foreground-color], you make it a lamp timer etc. interlocked with, and amendment of a color is possible.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, according to secular change of the emission spectrum of the optical variation of each element component, or a lamp etc., the color reproduction range will change with each projectors, and will change according to the use years of a lamp also in the same projector.

[0010] Moreover, in a projector with the optical system designed so that the chromaticity specification of a Hi-Vision signal might be suited, for example, when the NTSC signal from which chromaticity specification differs is inputted, a different color is reproduced and it does not become an original color in exact semantics with the projector which can make both methods serve a double purpose.

[0011] This invention aims at offering the projector in which color reproduction can do two or more methods with different color reproduction range in each appointed range.

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MEANS

[Means for Solving the Problem] The light source to which the liquid crystal projector of this invention emits the light of three components of red, green, and blue at least, The red separated by optical separation means to divide the light from the light source concerned into three components of red, green, and blue, and the optical separation means concerned, In a liquid crystal projector equipped with the projector lens which carries out expansion projection of a liquid crystal display means to be inserted into the optical path of the light of green and three blue components, and to modulate the light of said three components according to image information, a photosynthesis means to compound optically the light of three components which penetrated the liquid crystal display means concerned, and said image information The hue amendment constant according to the specification of various signal systems is stored at least, and it comes to have the means which carries out hue amendment corresponding to the specification of each signal system.

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OPERATION

[Function] By preparing two or more sets of color correction constants of two or more methods, according to an input signal, it can double with the color reproduction range, and appearance control can be carried out.

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EXAMPLE

[Example] First, it explains per principle of this invention. a x-y chromaticity-diagram top — setting — ** (x1, y1) — the chromaticity (x3, y3) of the color mixture of the coordinate to say, a color with brightness Y1, and a color with the coordinate of (x2, y2) and brightness Y2 and brightness Y3 can be expressed as shown in the following formula 1.

[0015]

[Equation 1]

$$x_3 = \frac{x_1 \frac{Y_1}{y_1} + x_2 \frac{Y_2}{y_2}}{\frac{Y_1}{y_1} + \frac{Y_2}{y_2}}, \quad y_3 = \frac{\frac{Y_1}{y_1} + \frac{Y_2}{y_2}}{\frac{Y_1}{y_1} + \frac{Y_2}{y_2}}$$

$$Y = Y_1 + Y_2$$

[0016] When the primary color B of the primary color G of the primary color R of a chromaticity (xR, yR) and brightness YR, a chromaticity (xG, yG), and brightness YG, a chromaticity (xB, yB), and brightness YB is obtained similarly, (x, y) of the color mixture of the three colors, and brightness Y can be expressed like the following formula 2.

[0017]

[Equation 2]

$$x = \frac{x_R \frac{Y_R}{y_R} + x_G \frac{Y_G}{y_G} + x_B \frac{Y_B}{y_B}}{\frac{Y_R}{y_R} + \frac{Y_G}{y_G} + \frac{Y_B}{y_B}}, \quad y = \frac{\frac{Y_R}{y_R} + \frac{Y_G}{y_G} + \frac{Y_B}{y_B}}{\frac{Y_R}{y_R} + \frac{Y_G}{y_G} + \frac{Y_B}{y_B}}$$

$$Y = Y_R + Y_G + Y_B$$

[0018] (x, y), and Y become the chromaticity of the white at the time of carrying out color

[0029] The example of the processing in a video signal is shown in drawing 3. Drawing 3 is the case where mix B in the case of G display, it mixes 20% and 30% of G signal respectively to R, and the stimulus values k_R and k_B are realized.

[0030] What is necessary is considering the case where not only G but B and R are amended, just to be able to form a matrix as shown in a formula 7.

[0031]

[Equation 7]

$$\begin{bmatrix} S' (G) \\ S' (B) \\ S' (R) \end{bmatrix} = \begin{bmatrix} K_{GG}, K_{BG}, K_{RG} \\ K_{GB}, K_{BB}, K_{RB} \\ K_{GR}, K_{BR}, K_{RR} \end{bmatrix} \cdot \begin{bmatrix} S (G) \\ S (G) \\ S (G) \end{bmatrix}$$

[0032] Here, K is [0033] when the target chromaticity of G, B, and R is set to (x_{RT}, y_{RT}) , (x_{GT}, y_{GT}) , and (x_{BT}, y_{BT}) .

[Equation 8]

$$x_{GT} = \frac{k_{GR} x_R + k_{GG} x_G + k_{GB} x_B}{k_{GR} + k_{GG} + k_{GB}}, \quad y_{GT} = \frac{k_{GR} y_R + k_{GG} y_G + k_{GB} y_B}{k_{GR} + k_{GG} + k_{GB}}$$

[0034]

[Equation 9]

$$x_{BT} = \frac{k_{BR} x_R + k_{BG} x_G + k_{BB} x_B}{k_{BR} + k_{BG} + k_{BB}}, \quad y_{BT} = \frac{k_{BR} y_R + k_{BG} y_G + k_{BB} y_B}{k_{BR} + k_{BG} + k_{BB}}$$

[0035]

[Equation 10]

$$x_{RT} = \frac{k_{RR} x_R + k_{RG} x_G + k_{RB} x_B}{k_{RR} + k_{RG} + k_{RB}}, \quad y_{RT} = \frac{k_{RR} y_R + k_{RG} y_G + k_{RB} y_B}{k_{RR} + k_{RG} + k_{RB}}$$

[0036] It is a constant by the side of the circuit which realizes the constant k which is alike and is calculated more.

[0037] This invention amends by constituting companion a radical by realizing a circuit for each formula mentioned above. Drawing 1 shows the example of a fundamental circuit which realizes the above. Actuation of this circuit is explained below.

[0038] Since the gamma correction is performed according to the property of CRT, a reverse gamma correction is performed in the reverse gamma correction circuits 1, 2, and 3, respectively, and the primary signal of G, B, and R which have been first sent from the circuit of the preceding paragraph is re-amended by the linear condition.

[0039] And the gain adjustment of the primary signal of G, B, and R which were re-amended by the linear condition is carried out in the gain equalization circuits 14-16, the gain equalization circuits 24-26, and the gain equalization circuits 34-36, respectively. And the primary signal of G, B, and R by which the gain adjustment was carried out is given to adders 11, 21, and 22, respectively, and three colors are mixed at a desired rate. That is, in a linear field, with the gain equalization circuits 14-16, 24-26, and 34-36 and adders 11, 21, and 22, the matrix circuit of G, B, and R is formed and it mixes at the rate of a request of three colors. The example of the video signal acquired at this time is given to drawing 4 as an example. Then, in order to return a video signal to the original condition, a gamma correction is applied in the gamma correction circuits 13, 23, and 33, respectively, and an amendment signal is sent to the circuit of the next step. And finally, it is projected on G, B, and R which were mixed at a desired rate on a screen,

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram of a hue amendment circuit showing the principle of this invention.

[Drawing 2] It is the block diagram of a hue amendment circuit showing the important section of this invention.

[Drawing 3] It is the mimetic diagram showing the example of signal processing for displaying amended G.

[Drawing 4] It is the mimetic diagram showing the example of the video signal after the hue amendment circuit in drawing 1 was mixed.

[Drawing 5] It is a liquid crystal projector drive circuit block diagram using this invention.

[Drawing 6] It is the mimetic diagram showing the color reproduction range amendment before and after amendment.

[Drawing 7] It is the optical arrangement block diagram of a general liquid crystal projector.

[Drawing 8] It is the mimetic diagram showing the color reproduction range displayed by the projector.

[Description of Notations]

4 Method Distinction Circuit

5 Microcomputer

6 Parameter Input Circuit

7 Lamp Time Circuit

14-16, 24-26, 34-36 Gain equalization circuit

11, 21, 22 Adder

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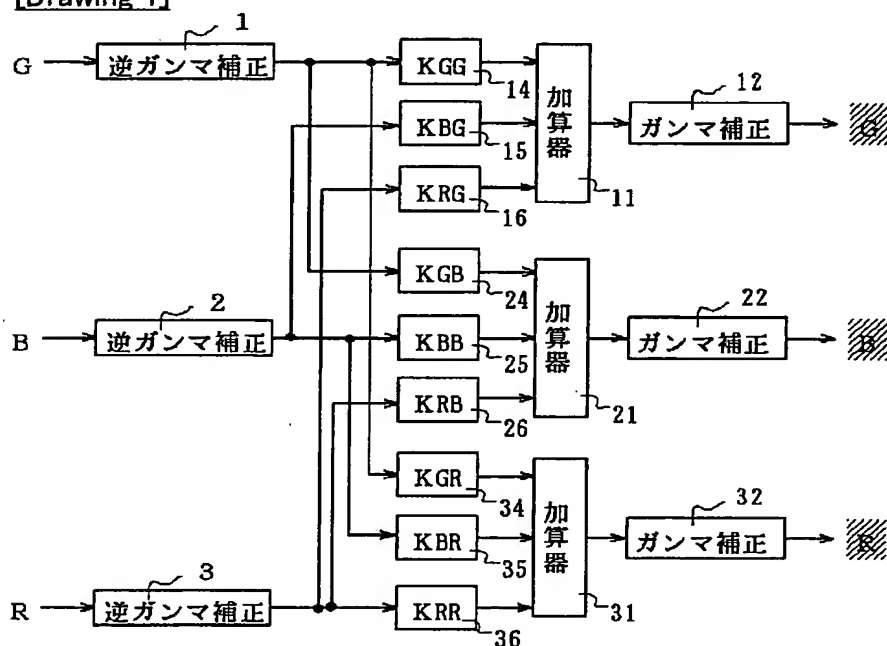
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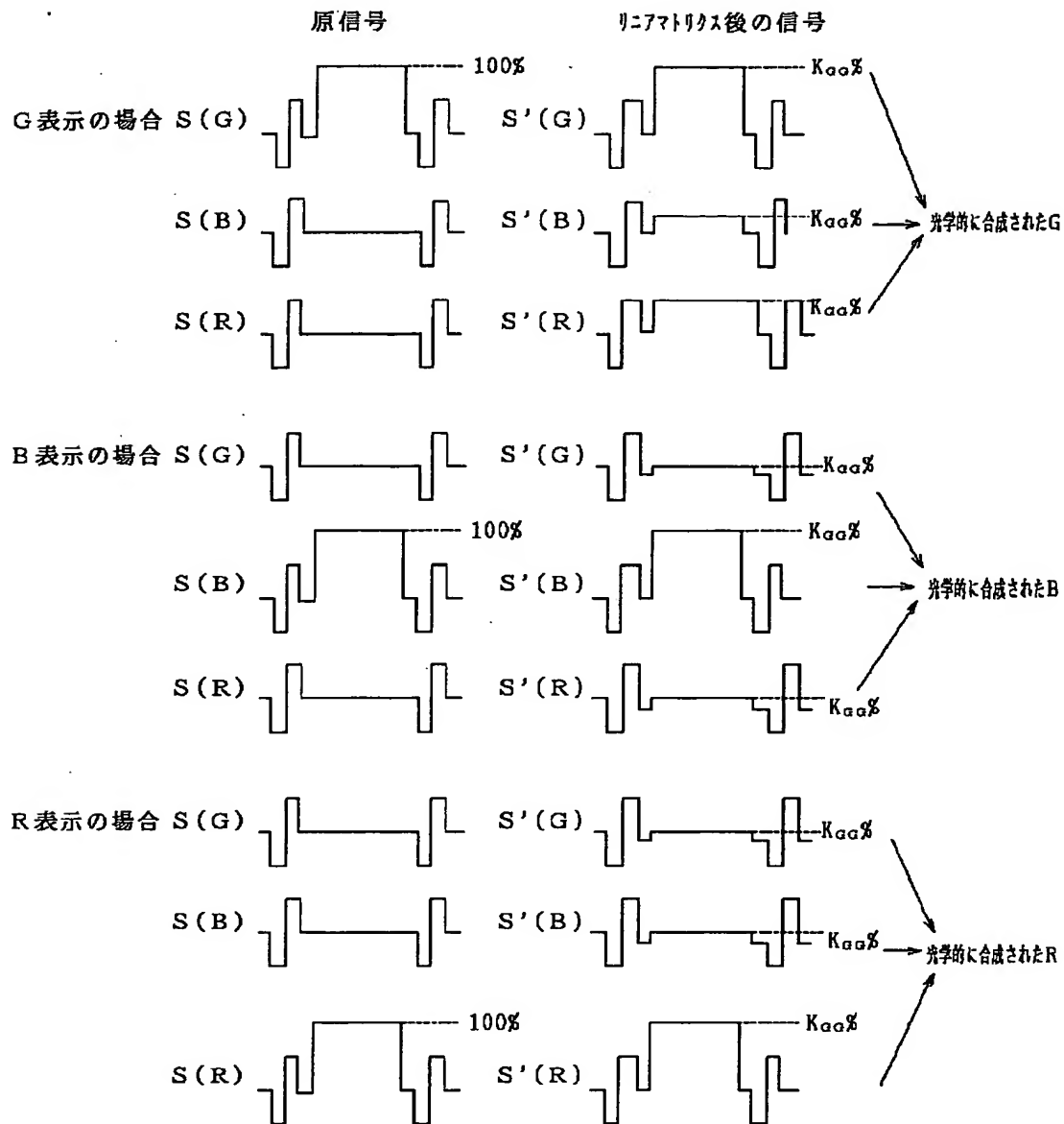
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DRAWINGS

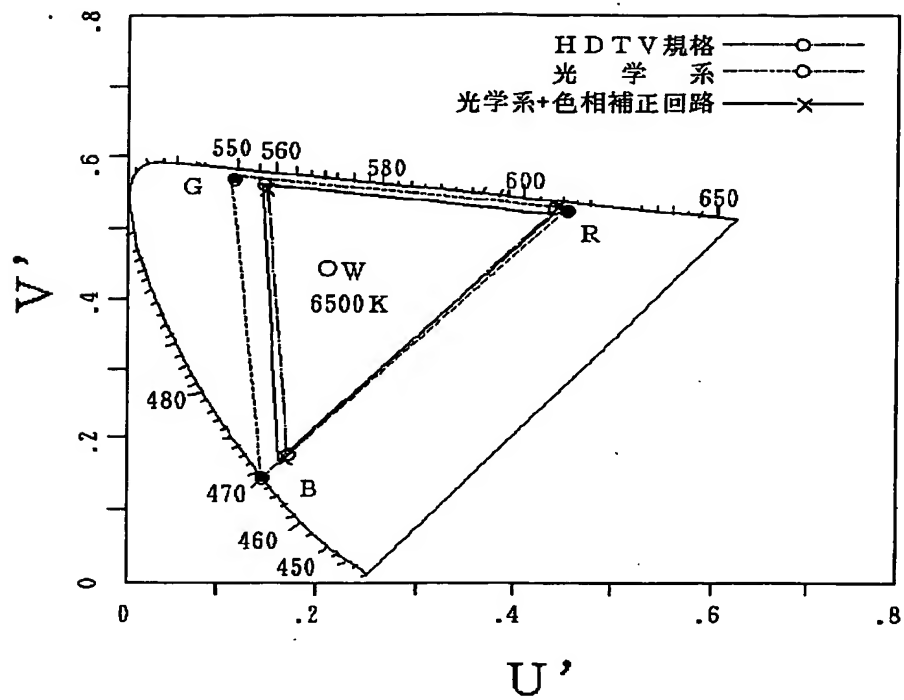
[Drawing 1]



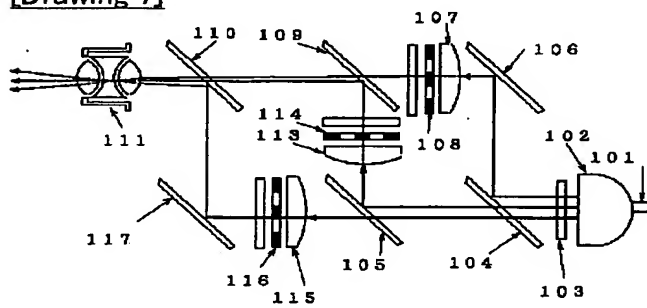
[Drawing 2]



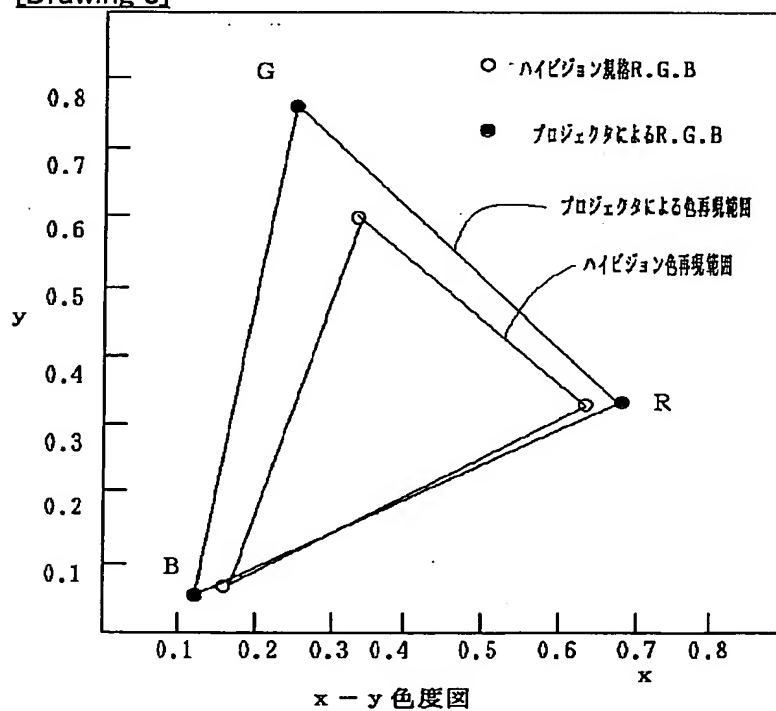
[Drawing 5]



[Drawing 7]



[Drawing 8]



(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

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G 0 2 F 1/13	5 0 5	7348-2K		
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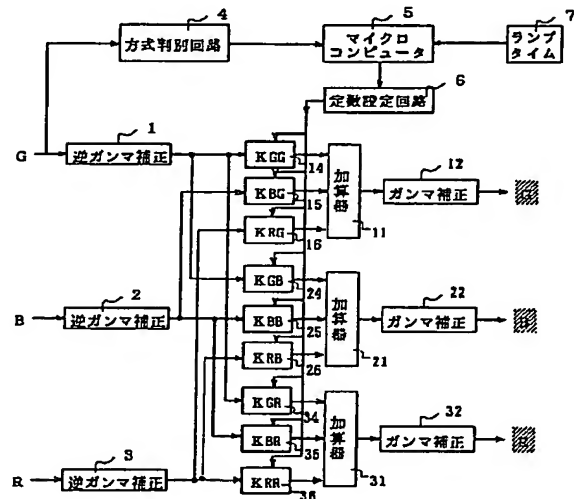
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(54) 【発明の名称】 液晶プロジェクタ

(57) 【要約】

【目的】 この発明は、異なる色再現範囲を持つ複数の方式を、それぞれの定められた範囲で色再現ができるプロジェクタを提供することを目的とする。

【構成】 この発明の液晶プロジェクタは、少なくとも赤、緑、青の3成分の光を発する光源と、当該光源からの光を赤、緑、青の3成分に分離する光分離手段と、当該光分離手段により分離された赤、緑、青の3成分の光の光路中に挿入され画像情報に応じて前記3成分の光を変調する液晶表示手段と当該液晶表示手段を透過した3成分の光を光学的に合成する光合成手段と前記画像情報を拡大投射する投射レンズとを備える液晶プロジェクタにおいて、少なくとも種々の信号方式の規格に応じた色相補正定数を格納し、各信号方式の規格に対応して色相補正する手段を備えてなる。



【特許請求の範囲】

【請求項1】 少なくとも赤、緑、青の3成分の光を発する光源と、当該光源からの光を赤、緑、青の3成分に分離する光分離手段と、当該光分離手段により分離された赤、緑、青の3成分の光の光路中に挿入され画像情報に応じて前記3成分の光を変調する液晶表示手段と当該液晶表示手段を透過した3成分の光を光学的に合成する光合成手段と前記画像情報を拡大投射する投射レンズとを備える液晶プロジェクタにおいて、

少なくとも種々の信号方式の規格に応じた色相補正定数を格納し、各信号方式の規格に対応して色相補正する手段を備えてなる液晶プロジェクタ。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、光源、液晶パネル、及び投射レンズを用いてカラー表示を行う液晶プロジェクタに関する。

【0002】

【従来の技術】従来、液晶表示装置として大画面の画像表示ができる投写型液晶表示装置が知られている。この投写型液晶表示装置では、光源から放射された光を液晶パネル上に照射し、この液晶パネルに映像信号に対応する光学像を形成させることにより照射光の強度変調を行って透過させ、その透過光を投射レンズに入射させて前記光学像をスクリーンに拡大投写するように構成されている。

【0003】このような投写型液晶表示装置において、フルカラー画像の表示を行う場合、例えば、図7の構成図に示すように、光源101から放射される光は、例えば反射面が放物面に形成されたりフレクタ102で一方向に向けられ、熱線及び紫外線をフィルタ103でカットした後、G反射ダイクロイックミラー104でG原色光（緑色光）が分離され、R反射ダイクロイックミラー105でR原色光（赤色光）とB原色光（青色光）とが分離される。

【0004】G反射ダイクロイックミラー104で分離されたG原色光は反射ミラー106で反射された後、G系用コンデンサレンズ107に入射して集光され、更に、G系用液晶パネル108に入射する。そして、この液晶パネル108に形成されるG系の映像信号に対応する光学像によって強度変調された後、液晶パネル108からR反射ダイクロイックミラー109、B反射ダイクロイックミラー110を透過して投写レンズ111に入射し、スクリーン112に拡大投写される。

【0005】R反射ダイクロイックミラー105で分離されたR原色光は、R系用コンデンサレンズ113に入射して集光され、更に、R系用液晶パネル114に入射する。そして、この液晶パネル114に形成されるR系の映像信号に対応する光学像によって強度変調された後、液晶パネル114からR反射ダイクロイックミラー

109に入射し、ここで反射されてG系の光学像と合成されてからB反射ダイクロイックミラー110を透過して投写レンズ111に入射し、スクリーン112に拡大投写される。

【0006】R反射ダイクロイックミラー105で分離されたB原色光は、B系用コンデンサレンズ115を透過した後、B系用液晶パネル116に入射し、この液晶パネル116に形成されるB系の映像信号に対応する光学像によって強度変調された後、液晶パネル116から反射ミラー117を経てB反射ダイクロイックミラー110に入射し、ここで反射されてG系及びR系の合成光学像と合成されてから投写レンズ111に入射し、スクリーン112に拡大投影される。

【0007】ところで、図7に示す光学系を持つ液晶プロジェクタにおいて、その色再現範囲は、例えば図8に示すようにCIEのxy色度図上で表される。

【0008】この色度図上の3原色の色度、輝度はランプの発光スペクトル、光分離、合成手段、偏光板などの光学的特性、液晶パネルの光透過特性、使用するスクリーンの光学的特性など様々な光学パラメータによって決定される。

【0009】

【発明が解決しようとする課題】しかし、各要素部品の光学的なバラツキやランプの発光スペクトルの経年変化などにより、色再現範囲は個々のプロジェクタによって異なり、また同一プロジェクタにおいてもランプの使用年数に応じて推移してしまう。

【0010】また、例えばハイビジョン信号の色度規格に合うよう設計された光学系を持つプロジェクタにおいては、色度規格の異なるNTSC信号を入力した場合、本来の色とは異なる色を再現してしまい、正確な意味において両方式の兼用が可能なプロジェクタとはならない。

【0011】この発明は、異なる色再現範囲を持つ複数の方式を、それぞれの定められた範囲で色再現ができるプロジェクタを提供することを目的とする。

【0012】

【課題を解決するための手段】この発明の液晶プロジェクタは、少なくとも赤、緑、青の3成分の光を発する光源と、当該光源からの光を赤、緑、青の3成分に分離する光分離手段と、当該光分離手段により分離された赤、緑、青の3成分の光の光路中に挿入され画像情報に応じて前記3成分の光を変調する液晶表示手段と当該液晶表示手段を透過した3成分の光を光学的に合成する光合成手段と前記画像情報を拡大投射する投射レンズとを備える液晶プロジェクタにおいて、少なくとも種々の信号方式の規格に応じた色相補正定数を格納し、各信号方式の規格に対応して色相補正する手段を備えてなる。

【0013】

【作用】複数の方式の色補正定数を複数組用意しておく

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ことで、入力信号に従ってその色再現範囲に合わせる様コントロールすることができる。

【0014】

【実施例】まず、この発明の原理につき説明する。x-y色度図上において (x_1, y_1) という座標、輝度 Y_1 ＊

$$x_3 = \frac{x_1 \frac{Y_1}{y_1} + x_2 \frac{Y_2}{y_2}}{\frac{Y_1}{y_1} + \frac{Y_2}{y_2}},$$

$$Y = Y_1 + Y_2$$

【0016】同様に色度 (x_1, y_1) 、輝度 Y_1 の原色R、色度 (x_c, y_c) 、輝度 Y_c の原色G、色度 (x_b, y_b) 、輝度 Y_b の原色Bが得られた場合、その3色の混色の (x, y) 、輝度 Y は次の数式2のように表せる。

【0017】

【数2】

$$x = \frac{x_1 \frac{Y_1}{y_1} + x_c \frac{Y_c}{y_c} + x_b \frac{Y_b}{y_b}}{\frac{Y_1}{y_1} + \frac{Y_c}{y_c} + \frac{Y_b}{y_b}}$$

$$y = \frac{y_1 \frac{Y_1}{y_1} + y_c \frac{Y_c}{y_c} + y_b \frac{Y_b}{y_b}}{\frac{Y_1}{y_1} + \frac{Y_c}{y_c} + \frac{Y_b}{y_b}}$$

$$Y = Y_1 + Y_c + Y_b$$

【0018】 (x, y) 、 Y はR、G、Bを混色した際※

$$x = \frac{k_1 x_1 + k_c x_c + k_b x_b}{k_1 + k_c + k_b}, \quad y = \frac{k_1 y_1 + k_c y_c + k_b y_b}{k_1 + k_c + k_b} = \frac{k_1 Y_1 + k_c Y_c + k_b Y_b}{k_1 + k_c + k_b} \quad (4) \text{式}$$

【0021】ここで、上記のR、G、Bの色度、輝度を何ら回路的な補正を行わない液晶プロジェクタにより得られたものと仮定すると、得られる白色はやはり上記の数式2によるものとなる。

【0022】 (x_1, y_1) 、 (x_c, y_c) 、 (x_b, y_b) に関しては光学的要素部品のパラメータによって決定されるため、回路的な補正による変更は不可能であるが、各単色の輝度 Y_1 、 Y_c 、 Y_b を回路的にコントロールすることは可能であるため、これのバランスを変更して白色の色温度をコントロールできることは明らかで

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＊を持つ色と、 (x_2, y_2) という座標、輝度 Y_2 を持つ色との混色の色度 (x_3, y_3) 、輝度 Y_3 は、次の数式1に示すように表わすことができる。

【0015】

【数1】

$$y_3 = \frac{y_1 \frac{Y_1}{y_1} + y_2 \frac{Y_2}{y_2}}{\frac{Y_1}{y_1} + \frac{Y_2}{y_2}}$$

※の白色の色度、輝度となる。ここで刺激値として、数式3のように定義すると、 x, y は k を用いて数式4のように表せる。

【0019】

【数3】

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$$k_1 (= \frac{Y_1}{y_1}), \quad k_c (= \frac{Y_c}{y_c}), \quad k_b (= \frac{Y_b}{y_b})$$

【0020】

【数式4】

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ある。

【0023】次に例えばG単色を表示する場合を考える。通常に得られる色度、輝度は (x_c, y_c) 、 Y_c であるが、意図的にR、Bの映像信号にGの信号を一部混合し、R、Bの液晶パネルに光の透過性を持たせると、得られる色度、輝度はやはり数式2で表されるものとなる。

【0024】ここで (x_1, y_1) という色度を得たい場合、数式4にこれを代入し k_1, k_b を k_c を用いて表すと次の数式5のようになる。

【0025】

* * 【数5】

$$k_1 = \frac{(x_1 - x_T)(y_1 - y_T) - (y_1 - y_T)(x_1 - x_T)}{(y_1 - y_T)(x_1 - x_T) - (x_1 - x_T)(y_1 - y_T)} \times k_c$$

$$k_2 = \frac{(x_1 - x_T)(y_1 - y_T) - (y_1 - y_T)(x_1 - x_T)}{(y_1 - y_T)(x_1 - x_T) - (x_1 - x_T)(y_1 - y_T)} \times k_c$$

【0026】ここで、 k_c の値は既知であるから k_1 、 k_2 は算出が可能となる。この k_1 、 k_2 になるようRとBの輝度 Y_1 、 Y_2 を回路的にコントロールすることにより、所望の色度 (x_T, y_T) が得られることになる。すなわち、Gを表示するときに、回路的には以下に示す数式6が実現できればよい。

【0027】

【数6】

$$S'(G) = K_c \cdot S(G)$$

$$S'(B) = K_1 \cdot S(G)$$

$$S'(R) = K_2 \cdot S(G)$$

※

【0028】ここでSは原信号、S'は補正後の信号、Kは最終的にスクリーンに投射された状態で上記の算出値kを実現する回路側の定数である。

【0029】図3に映像信号における処理の例を示す。図3はG表示の際にB、Rに各々20%、30%のG信号を混合して刺激値 k_1 、 k_2 を実現する場合である。

【0030】GのみではなくB、Rも補正する場合を考えると、数式7に示すようなマトリクスが形成できればよい。

【0031】

※

【数7】

$$\begin{bmatrix} S'(G) \\ S'(B) \\ S'(R) \end{bmatrix} = \begin{bmatrix} K_{c1}, K_{c2}, K_{c3} \\ K_{c1}, K_{c2}, K_{c3} \\ K_{c1}, K_{c2}, K_{c3} \end{bmatrix} \cdot \begin{bmatrix} S(G) \\ S(G) \\ S(G) \end{bmatrix}$$

【0032】ここで、KはG、B、Rの目標色度を (x_T, y_T) 、 (x_{c1}, y_{c1}) 、 (x_{c2}, y_{c2}) としたときに、

★ 【0033】

【数8】

$$x_{c1} = \frac{k_{c1}x_1 + k_{c2}x_2 + k_{c3}x_3}{k_{c1} + k_{c2} + k_{c3}}, \quad y_{c1} = \frac{k_{c1}y_1 + k_{c2}y_2 + k_{c3}y_3}{k_{c1} + k_{c2} + k_{c3}}$$

【0034】

☆

☆ 【数9】

$$x_{1T} = \frac{k_{11}x_1 + k_{12}x_2 + k_{13}x_3}{k_{11} + k_{12} + k_{13}}, \quad y_{1T} = \frac{k_{11}y_1 + k_{12}y_2 + k_{13}y_3}{k_{11} + k_{12} + k_{13}}$$

【0035】

◆

◆ 【数10】

$$x_{1T} = \frac{k_{11}x_1 + k_{12}x_2 + k_{13}x_3}{k_{11} + k_{12} + k_{13}}, \quad y_{1T} = \frac{k_{11}y_1 + k_{12}y_2 + k_{13}y_3}{k_{11} + k_{12} + k_{13}}$$

【0036】により計算される定数kを実現する回路側の定数である。

【0037】この発明は上述した各計算式に基づき回路を実現することにより構成することにより、補正を行うものである。図1は上記を実現する基本的回路例を示す。以下にこの回路の動作を説明する。

【0038】まず前段の回路より送られてきたG、B、Rの原色信号はCRTの特性に合わせてガンマ補正が施されているため、逆ガンマ補正回路1、2、3でそれぞれ逆ガンマ補正が施されリニア状態に再補正される。

【0039】そして、リニアな状態に再補正されたG、B、Rの原色信号は、それぞれゲイン調整回路14～1

6、ゲイン調整回路24～26、ゲイン調整回路34～36でゲイン調整される。そして、ゲイン調整されたG、B、Rの原色信号はそれぞれ加算器11、21、22に与えられ、3色が所望の率で混合される。すなわち、リニアな領域においてゲイン調整回路14～16、24～26、34～36と加算器11、21、22により、G、B、Rのマトリクス回路を形成し、3色が所望の率で混合する。この時得られるビデオ信号の例を図4に例として挙げる。その後、ビデオ信号を元の状態に戻すため、それぞれガンマ補正回路13、23、33でガンマ補正がかけられ、次段の回路に補正信号が送られる。そして最終的に、所望の割合で混合されたG、B、

Rがスクリーン上に投射され所望の色度を得ることができる。

【0040】図2は、数式7に示すマトリクスの定数Kを複数组用意しておき、入力信号に従ってその色再現範囲に合わせる様コントロールする用に構成したこの発明の要部を示すブロック図である。この実施例においては、定数設定回路6に上述した数式7に示すマトリクスの定数Kが複数组組み格納されている。そして、例えば、Gの原色信号を方式判別回路4に入力し、この方式判別回路4にて、どの方式であるか判別しその結果がマイクロコンピュータ5に与えられる。マイクロコンピュータ5はその結果に応じて、定数決定回路6からそれぞれの方式に対応し定数がゲイン調整回路14~16、24~26、34~36に与える。また、マイクロコンピュータ5にはランプの使用時間を計測するランプタイム回路7からの出力が与えられ、このランプの消耗による補正定数もゲイン調整回路14~16、24~26、34~36に与えるようになっている。ゲイン調整回路14~16、24~26、34~36と加算器11、21、22により、G、B、Rのマトリクス回路を形成し、3色を所望の率で混合する。その後、ビデオ信号を元の状態に戻すため、それぞれガンマ補正回路13、23、33でガンマ補正がかけられ、次段の回路に補正信号が送られる。そして最終的に、所望の割合で混合されたG、B、Rがスクリーン上に投射され所望の色度を得ることができる。

【0041】図6に本発明を含まない場合の色再現範囲と、本発明を採用した場合の色再現範囲の違いを示したものを示す。この図6は、本発明を用いてハイビジョンの色度規格に色再現範囲を合わせた結果である。当初の設計通り、光学系でハイビジョンの色再現範囲よりも若干広い色再現範囲を確保し、補正回路により規格に合わせることが可能となっていることがわかる。

【0042】図5に本発明を含む液晶プロジェクタの駆動回路のブロック図を示す。図5に示す駆動回路の動作につき説明する。まず、輝度信号(Y)と色差信号(PB, PR)は、マトリクス回路61でRGB信号に変換される。次にこの発明の特徴とする図2に示す回路で構成される色相補正回路62により、RGBの色度信号をそれぞれの規格に対応するように調整される。色相補正されたR、G、Bの信号は輪郭補正回路63において、約20MHzを中心に周波数特性が補正される。

【0043】次に、映像調整回路64、階調補正回路65で、コントラスト、ブライトネスを制御し、液晶パネル71のV-T特性にあわせた補正がかけられる。ま

た、カラーシェーディングの補正を行うため、ビデオ信号の水平方向、垂直方向に鋸歯信号やパラボラ信号が加算される。

【0044】そして、アナログスイッチとオペアンプにて構成された極性反転アンプ回路66により反転と増幅が行われ、データドライバ69、69に信号が与えられる。

【0045】また、SYNC同期信号は同期分離回路67で同期分離された後、タイミングコントローラ68に与えられる。タイミングコントローラ68は液晶駆動用パルスを発生し、そのパルスを色相補正回路62及び走査ドライバ70、70に与え、データドライバ69に入力された信号を液晶パネル71上に写す。

【0046】

【発明の効果】以上説明したように、この発明によれば、異なる色再現範囲を持つ複数の方式を、それぞれの定められた範囲で色再現ができるプロジェクタの実現が可能となる。またランプの経時変化による表示色度の経時変化に対しても、あらかじめ適した定数を設定しておけば、ランプタイムなどと連動させて色の補正が可能である。

【図面の簡単な説明】

【図1】この発明の原理を示す色相補正回路のブロック図である。

【図2】この発明の要部を示す色相補正回路のブロック図である。

【図3】補正されたGを表示するための信号処理の例を示す模式図である。

【図4】図1における色相補正回路に混合された後のビデオ信号の例を示す模式図である。

【図5】この発明を用いた液晶プロジェクタ駆動回路ブロック図である。

【図6】補正前と補正後の色再現範囲を示す模式図である。

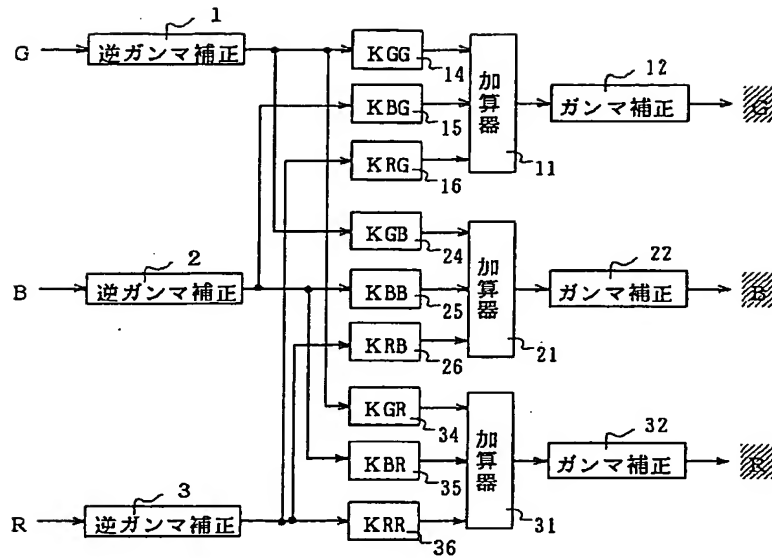
【図7】一般的な液晶プロジェクタの光学配置構成図である。

【図8】プロジェクタにより表示される色再現範囲を示す模式図である。

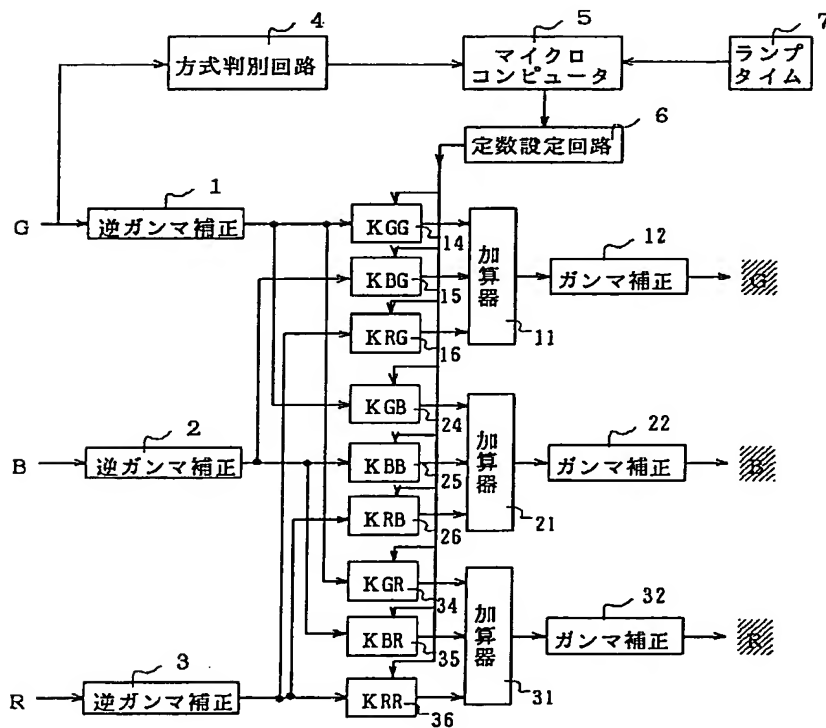
【符号の説明】

- 4 方式判別回路
- 5 マイクロコンピュータ
- 6 定数設定回路
- 7 ランプタイム回路
- 14~16、24~26、34~36 ゲイン調整回路
- 11、21、22 加算器

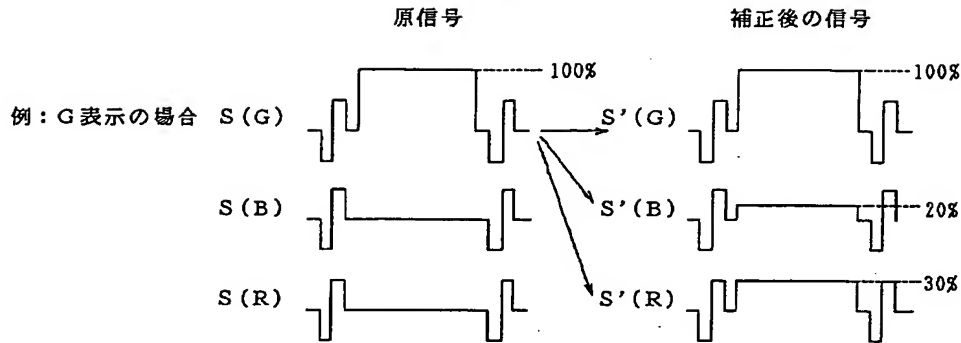
【図1】



【図2】



【図3】



【図4】

